

Patent Claims

1. Representation of at least one area of the earth's surface, characterized in that the area is subdivided into individual sections, and two data values are given for each of these sections, whereby the first datum (ELV) contains an elevation indication of the surface above a predetermined level, and the second datum (QTY) gives a measure of the accuracy and/or reliability of the first datum.
2. Representation according to the preceding claim, characterized in that the data are digital data.
3. Representation according to one of the preceding claims, characterized in that the earth's surface is divided into individual sections by a system of grid lines.
4. Representation according to claim 3, characterized in that the system of grid lines relates to the WGS-84 ellipsoid.
5. Representation according to one of the two preceding the previous claim, characterized in that each section corresponds to an area encompassed by two degrees of latitude and two degrees of longitude.
6. Representation according to one of the three preceding claims, characterized in that one, several, or all sections encompass an area of 30 x 30 arc-seconds.

7. Representation according to one of the claims 3 through 5, characterized in that one, several, or all sections encompass an area of 15 x 15 arc-seconds
8. Representation according to one of the preceding claims, characterized in that the first data (ELV) and/or second data (QTY) are indications regarding the geographic center of the section (cell-centered format).
9. Representation according to one of the preceding claims, characterized in that the elevation indication (ELV) of one, of several, or of all sections relates to mean sea level (MSL).
10. Representation according to one of the preceding claims, characterized in that the elevation indication (ELV) of one, of several, or of all sections indicates a maximum or minimum terrain elevation within the section.
11. Representation according to one of the preceding claims, characterized in that the elevation indication (ELV) of one, of several, or of all sections indicates an average terrain elevation within the section.
12. Representation according to one of the preceding claims, characterized in that the elevation indication (ELV) of one, of several, or of all sections indicates a weighted average terrain elevation within the section.

13. Representation according to one of the preceding claims, characterized in that the elevation indications (ELV) are defined in meters.
14. Representation according to one of the preceding claims, characterized in that the elevation indications of a section are decreased or increased by a predetermined value in order to contain indications of the type of terrain in the section.
15. Representation according to claim 14, characterized in that the first datum of a section contains the value -20000 or the elevation indication (ELV) less 20000 if the terrain of the section is a sea or an unknown type of body of water.
16. Representation according to one of the preceding claims, characterized in that the first datum contains the elevation indication (ELV) less 30000 if the terrain of the section is a sea or a river.
17. Representation according to one of the preceding claims, characterized in that the first datum contains a predetermined value (No-Data value) if no elevation indication can be determined for a section.
18. Representation according to the preceding claim, characterized in that the predetermined value is -9999.
19. Representation according to one of the preceding claims, characterized in that for one, for several or for all sections, the second datum (QTY) contains an indication of the horizontal

and/or vertical deviation, quality, reliability, and/or confidence level of the elevation indication of a section.

20. Representation according to one of the preceding claims, characterized in that for one, for several or for all sections, the second datum (QTY) indicates, in several stages or classes, the reliability or confidence level of the elevation indications.
21. Representation according to one of the two preceding claims, characterized in that the reliability is determined from the horizontal relative, horizontal absolute, vertical relative and/or relative *[sic]* absolute deviation of the elevation data of a section.
22. Representation according to one of the preceding claims, characterized in that the first data and the second data are stored in different files.
23. Representation according to one of the preceding claims, characterized in that the area of the earth's surface is divided into a number of segments, whereby each segment contains several sections, and
the first data and the second data of the sections, which collectively picture a segment of the earth's surface, are stored in one segment file each or together in a segment files *[sic]*.
24. Representation according to the preceding claim, characterized in that the first data (ELV) and the second data (QTY) are each stored in their own segment files.

25. Representation according to one of the two preceding claims, characterized in that one, several, or all segments are bounded by two adjacent degrees of longitude and two adjacent degrees of latitude.
26. Representation according to one of the two preceding claims, characterized in that one, several or all segments are bounded by the degrees of longitude and degrees of latitude of the WGS-84 ellipsoid.
27. Representation according to one of the three preceding claims, characterized in that several or all segments are bounded from one another by degrees of latitude and degrees of longitude in the same degree interval.
28. Representation according to one of the claims 23 through 27, characterized in that one, several or all segment files each contain the data of the sections of an area of the earth's surface $1^\circ \times 1^\circ$ in size.
29. Representation according to one of the preceding claims 23 through 28, characterized in that the data of the sections of a segment, each beginning with the northwest section, are stored in sequence one after the other in their progression on the circle of latitude in the easterly direction, whereby in the southerly direction, sequential rows adjoining one another are stored one after the other.
30. Representation according to one of the preceding claims 23 through 29, characterized in that one, several or all segment files exhibit a first, general header area in which are contained information concerning the position and/or extent or size of the

segment, and/or a second, file-specific header area in which are contained information concerning the program used for producing the segment file, the production date, the type of the elevation indication and/or the maximum or minimum elevations occurring in the segment, and information regarding the type of the second datum.

31. Representation according to one of the preceding claims, characterized by at least one file that indicates for each of the segments whether a segment file with elevation data exists for the segment in question.
32. Representation according to one of the preceding claims, characterized by at least one file that indicates for each of the segments whether no segment file exists for the segment in question, since the segment possesses only sea.
33. Representation according to one of the preceding claims, characterized by at least one file that indicates for each of the segments whether no segment file exists for the segment in question, since no elevation data are available.
34. Representation according to one of the preceding claims, characterized by at least one file that indicates for each of the segments whether a segment file with elevation data exists for the segment in question, and/or whether no segment file exists for the segment in question, since the segment possesses only sea, and/or whether no segment file exists for the segment in question, since no elevation data are available.

35. Method for creating a representation according to one of the preceding claims,

characterized in that

a) for each individual one or more data sources containing elevation data and optionally an accuracy and/or reliability indication for the elevation data contained in the data source for at least one part of the area to be represented, at least one of the following steps is executed in the following sequence or any desired sequence:

a1) importation of the data from the data source and conversion of the elevation data into a predetermined data format, and for each individual elevation datum, generation of a second value that represents the deviation of the elevation datum from the actual elevation, or an error value (variance) regarding the elevation datum (import),

a2) translation of the converted elevation data and/or the second values into a predetermined standard with regard to the horizontal plane (position) and/or the vertical direction (elevation) (convert),

a3) conversion of the converted and translated elevation data and/or second values to a predetermined horizontal resolution (adjust),

a4) check of the elevation data, optionally section by section, for credibility (trust), and computation and assignment of a second

datum for each elevation datum as a measure for the accuracy and/or reliability of the elevation datum,

a5) optionally, and to the extent that the elevation data represent average values for an area or a section, determination of a maximum elevation from the average values (offset);

b) for each elevation datum, a new elevation datum is created from the elevation data from all of data sources and/or a new second datum from the second data from all of the data sources (merge); and optionally

c) the created, new elevation data and/or new second data are converted into a predetermined data format (export).

36. Method according to the preceding claim, characterized in that the new second data are created from the second data from all data sources by means of Kalman filtering.

37. Method according to one of the two preceding claims, characterized in that the data sources that are to be used, the area of the earth's surface for which the representation is to be created, the steps that are to be executed and/or the predetermined parameters are determined and are stored in a process control file (process description file).

38. Method according to the preceding claim, characterized in that predetermined parameters of all of the steps that are to be executed

and the steps that are to be executed are stored in a collective process control file (process description file)

39. Method according to one of the claims 35 through 38, characterized in that the process control file contains the predetermined horizontal resolution as well as the type (maximum, average) of the elevation data of the representation that is to be created.
40. Method according to one of the claims 35 through 39, characterized in that after each step, the data created by that step (sx_convert/adjust/trust/offset/export) are stored.
41. Method according to one of the claims 35 through 40, characterized in that the subsequent step processes the data created and stored by the preceding step.
42. Method according to one of the claims 35 through 41, characterized in that in each step, the predetermined parameters that are used in that step are checked, the elevation data, and optionally, the second data or accuracy data, created by the preceding step or present in the data sources are imported and optionally checked, processed, and the processed elevation data and second data are optionally checked and finally stored.
43. Method according to one of the claims 35 through 42, characterized in that for each step, a log is stored of the data processing that took place (sx_xxxxx.log).

44. Method according to one of the claims 35 through 43, characterized in that the data sources exhibits *[sic]* no or one equal indication concerning the accuracy of the elevation data for all of the elevation data contained therein.
45. Method according to one of the claims 35 through 44, characterized in that before and/or after one, several or each processing step, for the preceding step the integrity and/or the reliability of the data and/or the proper execution of the step are checked.
46. Method according to the preceding claim, characterized in that for predetermined processing steps, the integrity and/or the reliability of the data and/or the proper execution of the step are checked.
47. Method according to one of the claims 35 through 46, characterized in that after step b) and/or after the last step, the integrity and/or the reliability of the data and/or the proper execution of the steps are checked.
48. Method according to one of the claims 45 through 47, characterized in that the results of the check are recorded in a log.
49. Method according to one of the claims 35 through 48, characterized in that in step a2, the data in the horizontal direction are translated to the WGS-84 system and in the vertical direction to mean sea level (MSL).

50. Method according to one of the claims 35 through 49, characterized in that in step a3 the data are converted to a horizontal resolution or extent of a section of an integer multiple of 1 arcsecond.
51. Method according to the preceding claim, characterized in that in step a3 the data are converted to a horizontal resolution or extent of a section of 30 arc-seconds or 15 arc-seconds.
52. Method according to one of the claims 35 through 51, characterized in that in step a4 the accuracy of the elevation data is checked individually for each section and each data source, and the second datum is modified in dependency on this result.
53. Method according to one of the claims 35 through 52, characterized in that in step a5 a maximum elevation is determined from the average elevation indications.
54. Method according to one of the claims 35 through 53, characterized in that a heuristic value (offset) is added to the average elevation indication.
55. Method for air traffic control of an aircraft, characterized in that during a flight of an aircraft, the current elevation, position and/or air route of the aircraft are determined, the elevation data and the second data of the representation according to one of the claims 1

through 34 are determined for the aircraft position and/or the air route, and these are compared with the current elevation and the air route of the aircraft.

56. Device for safeguarding an aircraft against contact with the ground,
c h a r a c t e r i z e d b y
a device for the storing of a representation according to one of the claims 1 through 34, a device for determining the elevation, the position and/or the air route of the aircraft,
a device for exporting individual or several sections of the representation, whereby those sections of the representation that represent the earth's surface at the ascertained position and/or on the ascertained air route of the aircraft are exported and are compared with the actual elevation and air route of the aircraft.